

Claims

What is claimed is:

- 5 1. A method for treating a disease characterized by low blood flow by inducing angiogenesis, the method comprising steps of:
- providing a patient suffering from a disease characterized by low blood flow;
- attaching a compression apparatus to a body part of the patient; and
- applying graded sequential compression to the body part of the patient using the
- compression apparatus, wherein the compression delivers a maximum pressure of
- less than 300 mm Hg.
- 10 2. A method for promoting wound healing, the method comprising steps of:
- providing a patient with a wound;
- 15 attaching a compression apparatus to a body part of the patient; and
- applying graded sequential compression to the body part of the patient using the
- compression apparatus, wherein the compression delivers a maximum pressure of
- less than 300 mm Hg.
- 20 3. The method of claim 1 or 2 wherein the graded sequential compression results in a reverse in direction of shear stress seen by the vascular endothelial cells of the patient.
4. The method of claim 1 or 2 wherein the graded sequential compression causes a 100%

change in shear stress seen by the vascular endothelial cells of the patient.

5. The method of claim 1 or 2 wherein the graded sequential compression causes a 50% change in shear stress seen by the vascular endothelial cells of the patient.

5

6. The method of claim 1 or 2 wherein the graded sequential compression causes a 200% change in shear stress seen by the vascular endothelial cells of the patient.

7. The method of claim 1 or 2 wherein the graded sequential compression causes a 400% change in shear stress seen by the vascular endothelial cells of the patient.

8. The method of claim 1 or 2 wherein the graded sequential compression is sufficient to cause a temporary collapse of the large arteries of the body part to which the compression means is attached.

15

9. The method of claim 1 or 2 wherein the graded sequential compression delivers a maximum pressure of less than 250 mm Hg.

10. The method of claim 1 or 2 wherein the graded sequential compression delivers a maximum pressure of less than 200 mm Hg.

20

11. The method of claim 1 or 2 wherein the graded sequential compression delivers a maximum pressure of less than 150 mm Hg.

12. The method of claim 1 or 2 wherein the graded sequential compression results in retrograde flow in the arterial vasculature of the patient.

13. The method of claim 1 or 2 wherein the graded sequential compression is timed with the cardiac cycle of the patient.

14. The method of claim 1 or 2 wherein the graded sequential compression induces secretion of angiogenesis factors.

15. The method of claim 1 or 2 wherein the graded sequential compression induces secretion of at least one molecule selected from the group consisting of platelet-derived growth factor, fibroblast-derived growth factor, epidermal growth factor, vascular endothelial-derived growth factor, prostaglandins, NO, leukotrienes, and cytokines.

16. The method of claim 1 or 2 wherein the graded sequential compression induces secretion of growth factors.

17. The method of claim 1 or 2 wherein the graded sequential compression induces secretion of angiogenesis factors by vascular endothelial cells.

18. The method of claim 1 or 2 wherein the graded sequential compression induces secretion of angiogenesis factors by cells selected from the groups consisting of muscle cells, fibroblasts,

epithelial cells, and smooth muscle cells.

19. The method of claim 1 or 2 wherein the compression apparatus is attached to at least one extremity of the patient.

5

20. The method of claim 1 or 2 wherein the compression apparatus is attached to at least one leg of the patient.

21. The method of claim 1 or 2 wherein the compression apparatus is attached to at least one arm of the patient.

22. The method of claim 1 or 2 wherein the compression apparatus is an inflatable bladder.

23. The method of claim 22 wherein the inflatable bladder may contain a gas.

24. The method of claim 22 wherein the inflatable bladder contains a liquid.

25. The method of claim 1 or 2 wherein the compression apparatus is a series of cuffs containing at least one inflatable bladder.

26. The method of claim 1 or 2 wherein the compression apparatus is a flexible, stretchable band capable of being under variable tension.

27. The method of claim 1 or 2 wherein the patient has peripheral vascular disease.

28. The method of claim 1 or 2 wherein the patient has cardiovascular disease.

5 29. The method of claim 1 or 2 wherein the patient has coronary artery disease.

30. The method of claim 1 or 2 wherein the patient has diabetes.

31. A method for treating a disease characterized by low blood flow by inducing
10 angiogenesis, the method comprising steps of:

providing a patient suffering from a disease characterized by low blood flow;

attaching an apparatus to a body part of the patient for delivering a negative pressure; and

applying negative pressure to the body part of the patient using the apparatus.

15 32. A method for treating a disease characterized by low blood flow by inducing
angiogenesis, the method comprising steps of:

providing a patient suffering from a disease characterized by low blood flow;

attaching an apparatus to a body part of the patient for delivering negative and positive
pressure;

20 applying negative pressure to the body part of the patient using the apparatus; and
applying positive pressure to the body part of the patient using the apparatus.

33. A method for promoting wound healing, the method comprising steps of:

providing a patient with a wound;

attaching an apparatus to a body part of the patient for delivering a negative pressure; and

applying negative pressure to the body part of the patient using the apparatus.

5 34. A method for promoting wound healing, the method comprising steps of:

providing a patient with a wound;

attaching an apparatus to a body part of the patient for delivering negative and positive
pressure;

applying negative pressure to the body part of the patient using the apparatus.; and

applying positive pressure to the body part of the patient using the apparatus.

35. An apparatus for compressing a part of a patient's body in order to induce angiogenesis or
wound healing, the apparatus comprising:

a source of fluid;

a compression structure for receiving the fluid;

a control means for controlling the fluid to achieve inflation and deflation of the
compression means, wherein the control means institutes inflation of the compression structure
so that graded sequential compression of the body part results with a maximum pressure of less
than 300 mm Hg.

36. The apparatus of claim 35 wherein the apparatus further comprises a blood oxygen
detector.

37. The apparatus of claim 35 wherein the apparatus further comprises a pulse oximeter.

38. The apparatus of claim 35 wherein the apparatus further comprises an EKG detector.

5 39. The apparatus of claim 35 wherein the apparatus further comprises a blood pressure detector.

40. The apparatus of claim 35 wherein the apparatus further comprises a means for heating or cooling the liquid.

41. The apparatus of claim 35 wherein the apparatus further comprises a means for accelerating the withdrawal of fluid from the compression means.

42. The apparatus of claim 41 wherein the means for accelerating the withdrawal of fluid
15 from the compression means comprises a vacuum pump.

43. The apparatus of claim 41 wherein the means for accelerating the withdrawal of fluid from the compression means comprises a negative pressure reservoir.

20 44. The apparatus of claim 35 wherein the compression structure comprises a means for mounting compression means on the body part.

45. The apparatus of claim 44 wherein the means for mounting is Velcro®.

46. The apparatus of claim 44 wherein the means for mounting is selected from the group consisting of buttons, snaps, elastic bands, and zippers.

5 47. The apparatus of claim 35 wherein the fluid is a gas.

48. The apparatus of claim 35 wherein the fluid is a liquid.

49. The apparatus of claim 35 wherein the source of compressed fluid is a gas compressor.

50. The apparatus of claim 35 wherein the source of compressed fluid is a tank of pressurized gas.

51. The apparatus of claim 35 wherein the compression structure is a balloon.

52. The apparatus of claim 35 wherein the compression structure is a bladder.

53. The apparatus of claim 35 wherein the control means comprises a computer.

20 54. An apparatus for compressing a part of a patient's body in order to induce angiogenesis or wound healing, the apparatus comprising:

at least one flexible band;

a means for mounting said band on the body part;

a control means for controlling the tension in the band and thus the band's resulting pressure on the body part.

FOR OFFICIAL USE ONLY